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ABSTRACT

The report summarized findings from a study of organizational issues involved in the use of microcomputers in special education programs in 12 school districts. Background of the study and details on site selection were given. Features of the selected districts (urbanicity, number of schools, enrollment, predominant ethnicity, and number of handicapped students), and of microcomputer systems (number in use, location, instructional applications, and administrative applications) were charted. The findings underlined the importance of collaboration with other microcomputer applications in the district and noted similarities in use by special and regular education. Applications for special education were identified, including administrative (such as child count data and student records) and instructional uses (such as computer assisted instruction, and vocational/career counseling and training). Specialized applications for special education were also identified, including as communication aids and individualized education program monitoring systems. Centralized and decentralized patterns of supervision were revealed, and factors important to the growth and utilization of microcomputers (including existence of skilled persons with authority) were noted. Analysis of the balance between instructional and administrative applications revealed that growth of microcomputer systems was strongest where mixed applications were present. Examination of training procedures revealed a variety of approaches and cited the importance of coordinators for growth beyond the initial adoption phase. Emphasis in special education applications on drill and practice exercises and educational games was noted along with a lack of integration with instructional management systems and ambiguous relationships to individualized education programs. (CL)

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MICROCOMPUTERS IN THE SCHOOLS-- IMPLEMENTATION IN SPECIAL EDUCATION

Information Product Number One
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Microcomputers in Special Education: Organizational Issues

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SRA Technologies
and
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MICROCOMPUTERS IN SPECIAL EDUCATION: ORGANIZATIONAL ISSUES

INTRODUCTION

Special education programs in the public schools provide a variety of services for handicapped students. During the 1970's, state and federal (e.g., P.L. 94-142) legislation placed new demands on local special education programs for increased organization, management, and provision of educational services. These requirements increased the paperwork and documentation; created greater need for interpersonal communication and cooperation among staff; and put a new emphasis on regular, accountable, individualized instruction and measurement of student progress. In this context, some educators have looked to a new technology, the microcomputer, to aid them in accomplishing the tasks associated with the comprehensive delivery of special education services. Microcomputer solutions to special education needs are being attempted in both instructional and administrative application areas.

Computer-assisted instruction (CAI) has been demonstrated as effective with handicapped students (Cartwright & Hall, 1974; Carmen & Kosberg, 1982; Hasselbring, 1982). Indirect support for the use of CAI in special education can also be inferred from findings reported in more general research. For example, reviewers have noted that the strongest positive effects of CAI were measured in lower-level coursework (Hartley, 1977; Kulik, 1981) and in instruction for "disadvantaged" (Jamison, Suppes, & Wells, 1974) or lower functioning students (Kulik, Bangert, & Williams, 1983).

In fact, there is strong support for prudent use of microcomputers in special education programs (Hofmeister, 1982; Taber, 1983). Many instructional features, characteristic of good CAI software, may be particularly beneficial in the education of handicapped children (Budoff & Hutton, 1982; Roblyer & King, 1983; Torgesen & Young, 1983).

In addition to CAI, microcomputers can also be used to assist special educators in a variety of information management tasks: from computer-managed instruction (CMI) in the classroom, to administrative record-keeping and word processing activities at the district level. Further, the potential value of microcomputers toward long-range vocational and social-living goals for handicapped persons has not been overlooked:

> It would be impossible to quote an exhaustive list of the special functions microcomputers could provide for disabled individuals. Almost any aspect of human activity that has been impaired could potentially be aided to some degree through the use of microcomputers as processors, manipulators or controllers. (Vanderheiden, 1982, p. 138)

Given this potential, and educators' current interest in microcomputer adoption, a study was sponsored by Special Education Programs (SEP), U.S. Department of Education, to investigate "Microcomputers in the Schools -- Implementation in Special Education." During spring 1983, case studies were conducted in 12 school districts that used microcomputers to support services in their special education programs. The focus of the research was an investigation of organizational issues related to the introduction of this technology. This report summarizes the major findings.

Methodology

Site Selection

During fall-winter of 1982, 98 school districts were identified that reported use of microcomputers in their special education programs. Although these districts did not represent a scientific sample, information about them was useful in identifying some of the characteristics that should be reflected in the planned selection of 12 school districts for the case studies:

- geographic dispersion;
- elementary and secondary programs;
- administrative and instructional applications;
- instructional applications with students representing a variety of handicapping conditions.

In addition to these characteristics, two other features were considered important to the research issues:

1. History. To adequately measure the process of implementation, it would be essential that microcomputers had been introduced at least one-and-a-half years prior to the case study investigation. This would permit examination of a sequence of implementation steps, including planning, adoption, allocation, management, training, and software acquisition.
2. Collaboration. Another area of particular interest was the interaction between special and regular educators in the use of the microcomputers. For this reason, the ultimate selection of sites would need to include districts where special education applications occurred independently, and districts where they represented joint or collaborative efforts.

Given these objectives, project staff initiated direct contacts with potential candidate school districts, to (1) verify and complete the necessary information regarding the nature of their applications, and to (2) secure their agreement to participate in the research.

In total, 26 candidates were contacted (by phone) to generate the 12 final selections. Four districts were rejected because the key participants in microcomputer implementation were no longer employed there. Other districts were rejected because verified characteristics differed from initially received information: no special education applications; mainframe rather than microcomputer applications; implementation was still in a planning stage, etc.

The final pool of 12 school districts was distributed as follows, in terms of two key factors considered important to the investigation:

	Number of Districts		
	Type of Application		
Program Collaboration	Administrative Only	Instructional Only	Admin. and Instructional
Special and Regular Education	0	5	2
Special Education Only	2	2	1

None of the selected districts used microcomputers exclusively in elementary programs; four of the microcomputer systems were secondary programs; the other eight were secondary and elementary. It should be noted that these characterizations of the microcomputer systems were based solely on the preliminary data and contacts with one or two key persons (usually administrators) in the district. The actual nature and extent of microcomputer applications, measured directly in the case studies, often differed from these initial descriptions.

Because the 12 school districts were purposively selected to reflect these characteristics of interest, the cases should not be considered a representative sample of school districts. Further, the types of handicapped students who participated in the microcomputer applications were often limited to mildly impaired and mainstreamed populations. These selection biases should be considered in the interpretation of findings presented in this report.

Research Design

A case study protocol was developed to guide the collection of information during the site visits. The protocol included a series of questions related to characteristics of school-based microcomputer systems and associated with the specific organizational issues to be investigated. These questions were to be answered by the field team, and not by any specific interviewee. The role of the case study investigator would be to accumulate evidence from a variety of sources, and on that basis to answer the questions posed in the protocol. Each question called for a synthesis of information from multiple sources: interviews, documentation, and field observation. This convergence of information would be assembled in much the same way that a good detective arrives at inferences about the facts in a crime (Yin, 1981).

Three field teams, each consisting of two project staff, conducted the case studies. Field team members were trained in case study methodology prior to initiation of the site visits. Twelve school districts were visited, during spring 1983. A field team spent one week on-site in each district and conducted interviews with key participants, including administrators and teachers, who were involved in the implementation of the microcomputers.

Characteristics of the Microcomputer Systems

A microcomputer "system" in a school district was operationally defined as a set of microcomputers shared by an identifiable group of users. The microcomputers could serve a variety of purposes and specific applications by users could be relatively independent. Nevertheless, the "system" was characterized by the presence of several decision-making patterns:

- coordinated decisions were made in the initial purchase and adoption of microcomputers;
- coordinated decisions were made regarding the allocation of microcomputers to different physical locations, to different applications, or to meet various scheduling needs;
- some functional interdepency existed among the units -- for example, in the formal sharing of software or the provision of maintenance; and
- some common arrangements were made to provide technical assistance or training to users.

Although more than one microcomputer system was present in some of the studied school districts, the case study investigation focused on the system of microcomputers that

was used, at least in part, to support special education services. The support could be instructional, administrative, or both.

The case studies were conducted in school districts in Arizona, California, Idaho, Louisiana, Massachusetts, Michigan, Minnesota, New Jersey, New York, Ohio, Virginia, and Wyoming. Table 1 provides an overview of the major characteristics of the school districts and microcomputer systems that were examined in the case studies.

Special Education Use of Microcomputers -- Collaboration or Specialization?

A key question to ask when planning microcomputer use in special education is--

> Does special education need its own system of microcomputers, or can special education applications be integrated with other microcomputer applications in the school district?

The case study results were very clear on this issue--

> Many special education needs could be satisfied within the context of a more general microcomputer system.

In fact, some of the most successful uses -- in terms of the numbers of teachers and students involved and the diversity and extent of applications made -- occurred in districts where the microcomputers were available to both special and regular education users. In many of these cases the differences in applications between the two groups were essentially transparent -- training for personnel was the same and the software and approaches to the microcomputers were identical.

It should be pointed out that the findings were based on case studies in only 12 districts and the microcomputer systems were, in some cases, purposively selected because they included both special and regular education users. Nevertheless, the successful experiences in these systems were a fact; this suggests that similar collaborative efforts could be carried out elsewhere. The following is a concise listing of the key findings reported on collaboration:

Initial Adoption of Microcomputers

- District-level special education staff were not heavily involved in the initial planning for adoption of microcomputers.
- Initial adoption of microcomputers, especially for instructional applications, was a "bottom-up" rather than "top-down" process; the first use of microcomputers for instruction was often initiated by a teacher, operating in relative isolation from district level administrators.
- Although collaborative planning (between special and regular education staff) occurred in some systems, it was not a requirement for subsequent sharing of the resources.

Later Collaborative Patterns

- Following the initial adoption of microcomputers, there was extensive collaboration between special and regular education: in purchase and allocation of equipment; in coordination, scheduling, and management of the microcomputers; in training staff; and in software selection and use.
- Special education administrators were often involved with other administrators in purchase and allocation of additional equipment.

School District and Microcomputer System (Case Study) Characteristics

trict	Predominant Urbanicity	Number of Schools	Total Enrollment	Predominent Ethnicity	Number Handicapped
A	suburban/rural	17	8,800	White	730
B	urban/suburban	38	21,000	White	1,889
C	urban/rural	29	13,000	White	1,486
D	suburban	11	9,200	White	600
E	suburban	9	6,900	White	800
F	suburban	1	1,250	White	450
G	suburban/rural	4	2,500	White	107
H	suburban	5	4,150	White	474
I	suburban	10	6,000	Mixed	710
J	suburban/rural	8	4,450	White	450
K	suburban/rural	7	2,800	White	210
L	suburban/rural	7	3,800	Black	380

eatures of Microcomputer Systems	A	B	C	D	E	F	G	H	I	J	K	L
umber of microcompuiers in case study	23	11	130	57	120	22	14	40	14	298	18	2
dditional microcomputers in district	29	38	9	17	-	7	9	8	13	-	-	11
ocation of microcomputers in case study:												
District Offices			X		X	X		X	X	X		X
School Offices	X		X		X	X			X	X	X	
Classrooms/resource rooms		X	X	X	X	X	X	X	X	X	X	
Media centers/labs	X		X	X	X	X		X	X	X		
nstructional Applications:												
Career Counseling/guidance			X						X	X		
Communication aides		X										
Computer-assisted drafting (CAD)						X			X			
Computer-assisted instruction (CAI)	X	X	X	X	X	X	X	X	X	X	X	
Computer-assisted music composition					X							
Computer literacy	X	X	X	X	X	X		X	X	X	X	
Computer managed instruction (CMI)					X				X	X		
Computer programming	X	X	X	X	X	X		X	X	X	X	
Office vocational education					X	X						
Word processing			X	X	X	X						
dministrative Applications:												
Accounting/budgeting						X						X
Attendance/enrollment				X		X			X			
Bibliographic Records (library)					X							
Class scheduling					X							
IEP development/monitoring										X		X
Inventory		X		X		X			X			X
Personnel records											X	
Student grades											X	
Student records			X	X	X			X	X	X		X
Test scores						X			X	X		
Transportation scheduling		X										
Word processing/mailing				X	X	X						X

- Special and regular education teachers frequently collaborated in decentralized (building-level) decisions on coordination, training, and use (including software selection) of the microcomputers.
- The only system (of the 12 cases) that did not demonstrate collaboration with regular education was a special education (only) administrative system. In the two systems that were designed solely for special education instructional applications, there was, nevertheless, some sharing of resources and other interactions with regular educators.

The Overall Pattern: Collaboration

- Training programs for special and regular educators were identical.
- Special education use of microcomputers for instruction emphasized computer-assisted instruction (CAI); regular education emphasized "computer literacy" and programming, but included CAI.
- CAI applications in special education and regular education were very similar in terms of software and approaches used; however, regular education use of CAI was more often restricted to "basic skills" (e.g., Chapter 1), vocational education, or younger (e.g., elementary level) students; special education CAI was implemented with elementary, intermediate, and secondary level students.
- Special and regular education teachers frequently shared hardware and software resources in the schools.

Special Education Applications--General

Across the studied districts, a broad variety of microcomputer applications were documented in special education. These included--

Administrative
- accounting/budgeting
- "child count" data
- IEP development and monitoring
- inventories of equipment and supplies
- report preparation
- student records
- student schedules
- test scores
- transportation schedules
- word processing/mailing

Instructional
- communication aides
- computer-assisted instruction (CAI)
- computer literacy and programming
- vocational/career counseling and training
- word processing

Four groups of handicapped students were most frequently targeted for instructional assistance with microcomputers:

- learning disabled;
- educable mentally retarded (and other mild/moderate classifications used by the LEAs);
- emotionally disturbed; and
- students with communication impairments.

The typical instructional application with handicapped students was considered CAI and generally emphasized "drill-and-practice" and educational game software. Commercial, public-domain, and locally developed ("home-made") software was in use, with varying degrees of reported effectiveness. Microcomputers were located in individual special education classrooms and resource rooms, or in media centers and computer labs.

Special Education Applications--Specialized

Most of the documented microcomputer applications in special education were similar to parallel applications in regular education: administrative uses included record-keeping and reporting, word processing, scheduling, etc.; instructional applications included CAI, computer literacy, etc. Nevertheless, a few applications were very specialized and geared to providing services to handicapped students--

Administrative:

- Two districts had implemented custom-designed, IEP development and monitoring systems; both of these systems were also made available and had been replicated in other districts.
- Many other districts indicated that they were planning or developing microcomputer-based IEP systems.

Instructional:

- One district used a microcomputer as a communication aide for a severely handicapped (traumatic spinal injury) student. The microcomputer was equipped with a special keyboard grid to permit the student, who had limited dexterity, to type input.
- Velcro strips were used on some keyboards to "hide" nonessential characters that might be distracting to some students.
- Some educational software had particular features that teachers felt were especially useful with handicapped students; these included large, clear letter-forms, auditory feedback, and color-coding.

In addition to these specialized applications, special educators also attested that certain aspects of microcomputer applications, although used similarly in special and regular education settings, were, nevertheless, particularly useful or beneficial in special education. On the administrative side, it was reported that microcomputer capabilities were especially useful in light of the record-keeping and report-generation requirements related to Public Law 94-142. Further, word processing/mailing list software was viewed as very helpful in supporting timely communication with parents.

On the instructional side, special education teachers cited a number of extra benefits from CAI for handicapped students:

- improved motivation
- increased attention
- behavior management (microcomputer time as a "reward")
- eye-hand coordination skills
- incidential improvement in reading and writing
- self-esteem
- individualization of lessons
- non-threatening instructional "tutor"
- effective visual and auditory cues to learning.

Supervising the Microcomputers--From the Top Down, or the Bottom Up?

Most school systems contain both centralized (district level, top-down) and decentralized (building and teacher level, bottom-up) decision-making patterns. The degree to which central administration determines what occurs in individual classrooms varies across and within school districts. Into this context, the microcomputer may be introduced and, subsequently, managed by school personnel at the top, or at the bottom. The organizational role and authority of the person(s) who attempt to implement this new technology may affect its acceptance into the system.

Further, the microcomputer itself has been described as a potentially decentralizing element in an organization:

> Freedom is fostered when the means of communication are dispersed, decentralized, and easily available, as are printing presses or microcomputers. Central control is more likely when the means of communication are concentrated, monopolized, and scarce, as are great networks. (de Sola Pool, 1983)

The issue, then, is double-edged:

1. Who is involved in implementing microcomputers and how do their roles affect the acceptance of the technology into the school system?
2. To what degree to features of the technology itself affect the organization and delivery of educational services.

To examine this issue, the case studies documented the supervisory patterns present in the districts, including the organizational framework for the special education program. The case studies examined the personnel and activities associated with microcomputer implementation; especially decision-making patterns related to planning, adoption, purchase, allocation, software review and selection, management of the units, and training. The following is a summary of the results of that investigation.

Centralized and Decentralized Patterns

- No pattern of centralization or decentralization dominated the supervision of microcomputers in the 12 case studies.
- Decision-making patterns showed variation over time -- key personnel shifted in their roles; teachers became official (administratively recognized) microcomputer "coordinators."
- In six systems, district level personnel were heavily involved in a centralized administration of the microcomputers; in four systems, control was highly decentralized -- building level and teaching staff introduced and managed the microcomputers; in two systems the overall pattern had shifted -- one from centralized to decentralized, the other from decentralized to centralized.

Development of Organizational Patterns

- The typical centralized pattern developed when a district level administrator played an early role in adoption and implementation of microcomputers.
- A decentralized pattern emerged when district level staff were involved only in an approval or funding capacity; the interest and expertise was concentrated at the school building level.

- Pitfalls of overly centralized supervision -- especially in later years, it can lead to allocation that disregards the needs or interests of intended users; microcomputers will be underutilized.

- Pitfalls of decentralized implementation -- growth of the system is sporadic; isolated applications are vulnerable to staff turnover; differing microcomputers will be incompatible, thus inhibiting sharing of resources; isolated applications foster redundancy and inefficiency.

- Organization of the system may also extend to physical location of the microcomputers--centralized, in media centers or "labs;" decentralized, in classrooms or individual resource rooms; in some districts, both patterns were in place.

- Excessive problems (incompatibility of hardware, competition for control of resources) in a decentralized system can lead administration to "clamp down" on microcomputers; in one district experiencing such difficulties, a moratorium on new purchases was instituted.

Does the Pattern Make a Difference?

- Neither centralized or decentralized patterns have clear advantages; growth (numbers of microcomputers and users) and utilization (number and diversity of applications) occurred with similar success in both types of systems.

Other factors seemed more important to growth and utilization of the microcomputers:

- Persons with key skills and authority were essential:

  1. recent or current teaching experience -- this encourages appropriate integration of microcomputer use within the classroom; and

  2. some control over administrative resources -- this provides decision-making authority and assures that sustained resources are made available.

- Persons with these skills can work as a formal or informal group, and the group may or may not be at the district level.

- District level program directors can ensure that microcomputers will be available to teachers within their programs by authorizing equipment purchases. For example, in many districts the availability of microcomputers for special education, basic skills, or vocational education teachers seemed directly linked to the authorization of program (e.g., special education, etc.) funds to purchase microcomputer hardware and software. Priority use of these resources by teachers and students in those programs seemed "protected," even when the program directors had been involved only in the initial authorization of funds and were not later involved in ongoing implementation decisions.

Microcomputers and Mainframe or Mini-computers

A secondary issue related to centralization/decentralization was the relationship of microcomputers to other computer systems in the school district. Microcomputers represent an inherently decentralized technology in comparison to the traditional mainframe or even mini-computer. The case studies examined whether any clear patterns of coordination or conflict appeared in systems that used both microcomputers and the larger computers.

- Smaller administrative tasks -- e.g., individual school enrollment and student records, mailing lists -- were implemented on microcomputers and, in

some cases, replaced similar, previous applications performed on larger systems.

- In some districts, instructional applications that had been conducted with larger computers were replaced by similar applications on microcomputers.
- Large-scale data reporting and analysis functions -- e.g., payroll, district student records, student reporting -- were perceived by administrators and data processors as more appropriate for larger computer systems.
- Dedication of different computer systems to different functions was seen positively as a way to increase the security of all systems and to give each function its rightful priority.

A few conflicts did occur in districts where microcomputers were replacing some functions conducted previously on larger computers:

- A director of data processing voiced concern over planned administrative use of microcomputers; he believed such applications would produce redundant data bases and other inefficiencies.
- In another district, the director of data processing initially supported microcomputers, but later felt they were competing for the same available resources.

Balancing Administrative and Instructional Applications

A common debate is whether or not administrative and instructional applications can be implemented within the same computer system. Previous research on mainframe computer systems in education has suggested that the balance of resources between these two types of applications can effect the growth and stability of the entire computer system (e.g., Yin, 1979). Some authors have viewed administrative applications as threats to instructional ones; according to their view, the administrative uses eventually dominate the computer system and displace the instructional uses (e.g., Naiman, 1982). In contrast, others have found that the initiation of administrative applications leads to greater organizational support for the entire computer system, and the instructional uses eventually benefit from one of several conditions -- the computer system is larger, has greater capabilities, or is installed more quickly (Yin, 1979).

To examine this issue in terms of microcomputer applications, the case study research examined school systems that had implemented administrative, or instructional, or both types of applications. In some cases, the system began with only one type of application, but later expanded to include both types. Therefore, the case studies also examined the presence of types over time -- to measure the relative growth and absorption of resources by each. The following is a summary of the findings.

Initial Patterns of Use

- In nine of the twelve cases, microcomputers were used initially for instructional applications only.
- In one case, adoption of microcomputers was for administrative application only; in two cases, both administrative and instructional applications were initiated from the outset.
- Many instructional applications were initiated by classroom teachers -- only later did administrative personnel become involved in response to the teachers' growing interest, requests for more equipment, and needs for technical assistance and training.

- In the districts that planned "mixed" uses -- administrative and instructional -- the purchased microcomputers were specifically allocated to either instructional or administrative applications, and resources (such as software) were allocated to support both types of uses.

Changes in Patterns of Use

- Seven of the nine systems initially designed for instructional applications added administrative applications; most (six) of these evolved at the school building (rather than district) level -- grade reports, scheduling, attendance, test scoring, equipment inventories, and curriculum development.
- In many districts that added administrative applications, new microcomputers were purchased and allocated to administrative (principal, superintendent) offices.
- In one district with "mixed" applications, separate "coordinator" positions were established to manage each.

Type of Application and Growth of the Microcomputer System

An interesting phenomenon was documented in the case studies. Growth of the microcomputer systems was strongest in systems with "mixed" applications, administrative and instructional.

- The instructional-only and administrative-only microcomputer systems, which had not changed over time to become mixed systems, did not markedly expand in terms of either the number of units, users, or additional applications.

A number of factors were posited to explain this:

- A single-focused application has a limited base of users and is especially vulnerable to staff turnover.
- Instructional-only applications are not as likely to secure enthusiastic administrative support.
- Addition of administrative applications to an instructional system, especially when accompanied by the purchase of additional equipment, expands the resource base of the system and, with training for new users, increases local expertise and knowledge.
- A larger resource (equipment) base is also more flexible and permits the introduction of additional applications and users. For example, the microcomputer provided to a principal may also be used for instructional applications in the school if the administrative needs do not require it full time.
- Finally, the adoption of microcomputers by administrators is a signal of administrative support for the new technology and encourages teachers to become involved.

The Coordination of Instructional/Administrative Use

Given the design of this study and the limited number of cases examined, it is not possible to draw a causal relationship between growth and the presence of mixed applications. Nevertheless, it can be inferred that the introduction of administrative applications into an instructional system does not necessarily restrict or inhibit the instructional uses. In this regard, a number of procedures were documented in the mixed systems that may have been important to this successful combination of objectives:

- Some districts purchased separate computers for the administrative applications.
- In one case, a deliberate decision was made to purchase different types of hardware (brands of microcomputers) to avoid any conflict or competition between the two groups of users.
- In cases where the same microcomputers were used for both types of applications, use (time) was carefully coordinated; administrative use was scheduled so as not to interfere with student use.
- In one district, students were directly involved in the administrative aplications: entering data, updating files, and operating business software were viewed as meaningful, vocational experiences for them.
- In some districts, administrative applications -- especially computer-managed instruction (CMI) and test scoring -- were seen as very complementary to special education instructional applications.

Interestingly, in a few districts where instructional use of microcomputers was preceded by instructional applications on larger computer systems, many teachers reported that their earlier (mainframe and mini-computer) experiences had been very negative. They were regularly being "bumped" by a priority usage for administrative applications. In some cases, this was stated to be a major factor in their initial desire to introduce microcomputers. In contrast, the introduction or expansion of administrative applications into instructional microcomputer systems did not appear to result in such conflicts. Additional reasons that could have supported this benevolent outcome included:

- In all the districts with mixed applications there seemed to be an understanding of the sacrosanct nature of each: administrators and teachers respected each others' needs and wanted to insure mutual cooperation because it led to growth and success of the total system.
- Administrative uses (especially at the school building level) tended to grow gradually and were limited to only a few users. Consequently, administrative demand for use of the microcomputers did not race ahead of the resources available -- particularly since administrators were now more supportive of microcomputers and interested in acquiring more equipment.
- Mainframe and mini-computers represent a fairly fixed (and expensive) commodity. In contrast, when administrative needs for microcomputers increase, additional units can be added and the system as a whole can grow in an incremental fashion.

Training and Emerging Roles for Special Educators with the Use of Microcomputers

School districts used a variety of approaches to prepare teachers to use microcomputers. This ranged from self-instruction and individualized technical assistance, common in the initial stages of microcomputer adoption, to large-scale, district-wide inservice courses, typical in districts where the microcomputer implementation had experienced major growth and represented an important part of the curriculum.

Training and the Growth of the Microcomputer System

Prior to conducting the case studies, the researchers anticipated that the level of training activities in the school district would be positively associated with the growth of the microcomputer system. Proxy measures of growth included:

- the number of users (teachers and students)
- the number of microcomputers and related equipment
- the number of applications
- the diversity of applications.

The research supported this assumption but found that the association was strongest between training and utilization (number of users and applications, diversity of application) and less viable between training and the number of microcomputers.

- The number of microcomputers increased (from 1979 to 1983) in all districts.
- Systems with the largest number of microcomputers in 1983 were also the districts with histories of major training resources available to teachers.
- However, in some districts the increases in numbers of microcomputers outstripped the available training opportunities, and the microcomputers were underutilized.

Progression of Training Activities

- The first microcomputer users were often self-instructed -- reading magazine articles and books, studying software documentation, taking outside (i.e., college) courses.
- Early adoption of microcomputers usually included one-to-one technical assistance provided to new users by the original "zealots."
- In systems with major growth, available training resources included:
  - -- district-wide group inservice training
  - -- building level inservice training
  - -- user orientation workshops
  - -- parent workshops
  - -- training made available to educators from other districts
  - -- classes provided by local colleges
  - -- school clubs and user groups
  - -- technical assistance by local "microcomputer coordinators."

These results suggested that group training was not required during initial planning or early adoption stages, but larger inservice training resources were strongly associated with later expansion of microcomputers into the curriculum.

Effective Training Approaches

A variety of approaches for preparing staff to use microcomputers were documented in the case studies. Local educators attested to the benefits and disadvantages of each.

- Many administrators felt that it was extremely important to require new users (not the initial "zealots") to be trained before they were provided with microcomputers:
  - -- In one district, teachers were not given microcomputers until after they completed an eight-week inservice training course that included hands-on experience and written reviews, by the teachers, of at least three educational software programs.
  - -- In another district, the teachers were trained and then required to develop a formal plan demonstrating how they would use the microcomputers in their classrooms, as justification for receiving them.

- Programming, such as in BASIC, was not an appropriate objective for introductory inservice training. Most teachers were not interested in learning how to program; they simply wanted to be able to use the microcomputers.
- Effective content for introductory training included:
  - -- microcomputer operations, features, and hardware
  - -- loading and running CAI software
  - -- integrating computers with the curriculum
  - -- knowledge of available software and what it will do
  - -- how to review, select, and acquire additional software
  - -- saving programs and copying diskettes.
- Effective content for later (advanced) inservice training:
  - -- programming (especially BASIC);
  - -- authoring languages;
  - -- word processing;
  - -- computer-managed instruction (CMI);
  - -- other administrative applications.
- A major problem in district-sponsored inservice training occurred in decentralized systems where there were incompatibilities in the hardware used in different schools and classrooms. A partial solution was provided through district sponsorship of "user groups" which then provided training tailored to particular microcomputers.

Training for Special Education Teachers

In none of the studied districts was the content of training offered to special education teachers any different than that offered to other school personnel.

- Introductory training areas for special and regular education use of microcomputers were the same.
- The dominant CAI software -- drill-and-practice, educational games -- was used similarly by special and regular educators and training requirements for both groups were the same.
- Separate training sessions were offered for special education teachers in one district. However, the training content was the same (as that offered regular education teachers); separate training was offered to stimulate their interest in the already established microcomputer system.

As previously noted, the instructional applications in special education were generally limited to CAI and, therefore, the training requirements for using this technology may be considered similar for special and regular teachers. More advanced or atypical applications, which may be of particular benefit to handicapped children, would require specialized training. The few cases of such specialized applications documented in these case studies -- communication aids, special adaptations of the hardware -- were implemented in isolated cases and supported by individualized technical assistance or self-instruction for the teachers.

Emerging Roles

When growth occurs beyond the initial adoption of microcomputers, the need for coordination of the microcomputer system evolves, and the roles of formal or informal coordinators emerge. In each of the school districts studied, an individual or a group of key persons had responsibility for some of the following tasks:

- purchase and allocation of the microcomputers
- review, purchase, and distribution of software
- maintenance of a central file/catalog of software
- scheduling and planning computer use
- training and technical assistance to users.

All districts with instructional microcomputer systems had groups of educators who were involved in planning and managing microcomputer applications:

- Many, but not all, districts used a group of individuals to plan the initial adoption.
- Some coordination groups were formally established, but most were informal -- even though they often included district level (e.g., assistant superintendent) personnel.
- Coordination groups included and relied heavily upon individuals who were the early adopters or propagandists for microcomputers in the district; these "zealots" represented the critical knowledge base for microcomputer applications.

Most districts established formal "coordinator" positions:

- In a few cases, where the microcomputer implementation occurred under the aegis of a government (e.g., Title IV-C) project, the coordinator positions were funded through the grant and discontinued with its termination.
- In some cases, a district level microcomputer coordinator position was established; this person was responsible for the overall management and -- with input from school-based administrators and teachers -- planning of microcomputer activities.
- In most cases, the coordinators were school-based -- teachers or consulting teachers who had been involved with microcomputers from the start. Many of these were formal designations, but many more represented the voluntary assumption of these responsibilities by the teachers.
- The decentralized (school-based) coordinators were also expected to fulfill their other educational responsibilities; coordination was considered, at most, to be a part-time responsibility. In a few cases, microcomputer coordination was viewed as, simply, another function of already established roles -- special education consulting teacher, career counselor/coordinator.
- In a number of cases, school librarians or media center directors were given some responsibility for coordination and management of microcomputers.

Does a Coordinator Make a Difference?

- Emergence of "coordinator" positions was a characteristic of growing microcomputer systems. After the early, decentralized adoption of microcomputers, district and school administrators seemed to recognize the importance of coordination to improve management (of numerous units) and to reduce inefficiencies, redundancies, and incompatibilities (of equipment) across users.
- Even where administration was not particularly supportive or interested in microcomputer applications, the teachers seemed to identify their own resource persons, among the staff, and rely on them for technical assistance and guidance.

- Coordinators were key developers and presenters of inservice training on microcomputers for other district staff.
- Coordinators who were perceived as most effective by teachers were those who had already had microcomputer experience in the classroom.

OVERVIEW -- MICROCOMPUTERS AND SPECIAL EDUCATION

The research documented the implementation of microcomputers to serve a variety of functions in special education. The findings were particularly satisfying in the sense that, on the whole, they reflected rapidly developing and expanding systems of use and demonstrated collaboration and satisfaction among educators.

On the other hand, the most common special education applications examined in the case studies consisted of very basic "drill-and-practice" exercises and educational games. In many cases, these CAI uses were not integrated with instructional management systems and their relationship with IEPs was not clear. To some degree, the healthy collaboration and resource-sharing between special and regular education reflected the simplicity of the instructional applications.

It is true that this is a new technology and, at least in the near future, its use will be partly experimental in nature. Nevertheless, this uncertainty suggests that greater attention should be given to planning, monitoring, and evaluating the use of microcomputers in special education. However, in many of the studied cases, special education administrators were not directly involved in management of the microcomputer systems. There were a number of possible reasons for this:

- Special education administrative staff were relatively few in number and their time was heavily allocated to other tasks: assessment, placement, records and reports, etc.
- The impetus for instructional applications came from the teachers; it was a "bottom-up" phenomenon and the knowledge-base for instructional applications was decentralized--in the school buildings and classrooms.
- In an atmosphere of reduced local budgets and increasing demands for services, special education administrators were often reluctant to provide funds for purchase of microcomputer equipment. Special education teachers, therefore, relied on equipment purchased or provided with other resources. In using this equipment, the teachers interacted more often with other administrators (principals, microcomputer coordinators) than with special education administration.

This context may explain why special education applications were often similar to microcomputer uses in other school program areas. On the positive side, this suggests that special education staff can take advantage of hardware/software that is already in a school and use it effectively with their students. However, this also suggests that such collaborations may not foster special applications or approaches that would be particularly beneficial to handicapped students. Ultimately, special education administrators may have to take a more active role in the planning and management of microcomputer systems to encourage more specialized use of this technology in programs for handicapped students.

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